Diver's Visual Interface System (DVIS)

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LONG-TERM GOAL

The navy conducts critical mine countermeasures (MCM) operations in extremely difficult and challenging regions, such as the very shallow water/surf zone (VSW/SZ). Current MCM operations rely heavily on the skills of trained Explosive Ordnance Disposal (EOD) and VSW MCM divers employing a suite of advanced underwater sensor platforms for the detection, classification, identification, and localization of mines and other small objects underwater.
While the desired long-term goal of such operations is to completely remove the diver from this environment, relying on fully autonomous technology, near-term operations will continue to rely heavily on direct diver intervention. The goal of the project is to develop and provide technology that will increase the diver's effectiveness using the various sensor platforms, resulting in reduced (shortened) exposure to the high threat environment and subsequently increasing safety.

OBJECTIVE

Visibility in the VSW/SZ region is extremely limited. To enhance a diver's ability to operate in this restricted environment, the Integrated Navigation Sonar System/Underwater Information System (INSS/UIS) has been developed. The INSS/UIS is a diver-based tool used during VSW MCM and EOD missions. The INSS/UIS employs an integral video display screen with the Diver Held Unit (DHU) that presents sonar and navigation data to the diver. Unfortunately, underwater visual displays are difficult to impossible to see under extremely adverse visibility conditions of the VSW/SZ region.

The objective of this project is to solve the problem associated with operating the INSS/UIS in the VSW/SZ poor visibility environment. This will be accomplished by designing and developing a new ancillary Diver Visual Interface System (DVIS) specifically for the INSS/UIS in the form of a diver Head-Mounted Display (HMD), that will measurably improve operator performance under the current adverse environmental conditions. Three prototypes will be delivered for evaluation upon the completion of the project. Figure 1 shows a conceptual design for the DVIS with the KMS-48 Full Facemask.

Figure 1: DVIS Concept

APPROACH

DVIS Technical Requirements Document

The first step will be to clearly define the set of technical and operational requirements for the DVIS as it functions with the INSS/UIS. Required display resolution, magnification, limits on physical size, weight and buoyancy, specific dive mask (s) employed, and signal interface with the INSS/UIS must be determined. These requirements will be established in a formal document that will govern and direct the DVIS design. This will require detailed technical input from EOD & VSW MCM detachment personnel (end users).

Enabling Technologies Research, Testing, & Evaluation

Following the establishment of the technical requirements, research into state-of-the-art microdisplay and optical technologies will be conducted. The most promising candidates will be procured for functional testing and human factors evaluation. The key microdisplay and optical design approach will be selected and established, and will lead into the Preliminary System Design.

Preliminary System Design (PSD) & Engineering Development Models (EDMs)

A Preliminary System Design will proceed built around the DVIS technical requirements and the selected microdisplay and optical technologies. This PSD will most probably be a synthesis of commercial-off-the-shelf (COTS), modified-off-the-shelf (MOTS), and custom designed technologies. After a Preliminary Design Review (PDR), non-diveable Engineering Development Models (EDMs) will be fabricated to perform functional and human factors testing with the specified dive mask (s).
Final Design & Advanced Development Models (ADMs)

Following testing and evaluation of the EDMs (and incorporating final end user inputs), the final DVIS design will proceed. This will involve fabrication of rugged, waterproof units capable of operation in up

to 300 FSW, and full system integration. Three ADMs will be fabricated and will undergo full environmental, and magnetic signature testing, as well as human factors evaluation. User field evaluations with the INSS/UIS will take place at the VSW MCM test detachment.

Lo-Mu Engineering (LME) Analysis

For the DVIS to successfully transition for use with the INSS/UIS in the fleet, it will eventually need to meet the specified EOD and VSW MCM magnetic signature requirements (reference MIL-M-19595C). To minimize the risk for this future transition, a Low-Mu Engineering (LME) analysis will be conducted concurrently during each phase of the project development process. While the DVIS deliverable components will not be low-mu hardware, the final project report will include design, schedule, and cost information identifying a path to manufacture a future low-mu DVIS to meet EOD & VSW MCM operational requirements.

WORK COMPLETED

This project is a new start late in FY00. The DVIS Technical Requirements Document has been completed with extensive input from the EOD & VSW MCM detachment end users.

RESULTS

Since this project is a new start late in FY00, there are no significant results to report apart from the completion of the DVIS Technical Requirements Document.

TRANSITIONS

A subsequent acquisition program would transition the DVIS to the fleet as part of the INSS/UIS.

RELATED PROJECTS

The Office of Special Technology is currently developing a Miniature Diver Display (Task 491) under the Explosive Ordnance Disposal/Low Intensity Conflict (EOD/LIC) Program. This miniature diver HMD will be a small, monocular (single-eye viewing), color display unit for specific use *as a general development tool,* not for any specific piece of equipment. It will integrate available COTS technologies, no custom technologies will be developed. The Miniature Diver Display would be used to assist EOD/LIC and similar programs in the development of other diver-based sensors (such as sonars, navigation systems, and various camera and imaging technologies) that rely on a color display screen output. In order to be a fairly low-cost and versatile *development tool*, the Miniature Diver Display will be configured for use with the standard MK-20 (AGA-type) full facemask, and have a standardized signal interface. No LME analysis will be conducted.

The Office of Special Technology (EOD/LIC Program) is also developing an Integrated Diver Display Mask (Task 332). This comprises a miniature, segmental, liquid crystal display (similar to a digital watch) integrated inside a scuba mask. This system provides the diver's depth, elapsed dive time, and tank pressure (through a wireless RF data link) to the diver using a custom optical system. This system has no graphical, color, or video display capability.